



**48th IUPAC World Conference on Chemistry Education &  
104th Canadian Chemistry Conference and Exhibition**  
Solving Global Challenges with Chemistry

*Symposium: Systems Thinking in Chemistry Education. Virtual Conference, 13-20 August 2021.*

## **Ammonia: smelling salts for systems thinking in chemistry education**

J. Marc Whalen,<sup>a\*</sup> Peter G. Mahaffy,<sup>b</sup> Jaclyn J. Stewart,<sup>c</sup> Thomas A. Holme,<sup>d</sup> Stephen A. Matlin<sup>e,f</sup>

- a. Department of Chemistry, Dalhousie University, Halifax, Nova Scotia B3H 4R2, Canada
- b. Department of Chemistry and the King's Centre for Visualization in Science, The King's University, Edmonton, Alberta T6B 2H3, Canada
- c. Department of Chemistry, the University of British Columbia, Vancouver, British Columbia V6T 1Z1, Canada
- d. Department of Chemistry, Iowa State University, 2415 Osborn Drive, Ames, IA 50011, USA
- e. Institute of Global Health Innovation, Imperial College London, London SW7 2AZ, UK
- f. International Organization for Chemical Sciences in Development, 61 rue de Bruxelles, B-5000 Namur, Belgium

### **Abstract**

Ammonia is a fundamental commodity playing vital roles in most large-scale human activities, including global food production, refrigeration, and explosives for construction. Additionally, ammonia is the starting material for most nitrogen-containing chemicals and materials. Its properties and existing large-scale production and transportation infrastructure make it one of the strongest candidates for an energy carrier in a future low-carbon economy. However, aspects of its large-scale use are problematic, including its production from fossil fuels and the unsustainable accumulation of reactive nitrogen in the environment.

An examination of the global systems impacted (and sustained) by ammonia provides the opportunity to integrate current global issues and concerns, including energy, food, and environment into a variety of chemistry courses. Teaching these topics with a systems-thinking educational approach may increase students' awareness and perceptions of relevance of chemistry across all human activity.

This talk summarizes global systems involving ammonia, providing a rich pool of examples cross-cutting all sub-disciplines of the traditional chemistry curriculum. Many of the existing core concepts in chemistry can be taught using the global systems of ammonia as key examples, thus not requiring additional space in the chemistry curriculum.

### *Suggested citation:*

J. M. Whalen, P. G. Mahaffy, J. J. Stewart, T. A. Holme, S.A. Matlin. *Ammonia: smelling salts for systems thinking in chemistry education*. Paper presented at **48th IUPAC World Conference on Chemistry Education / 104th Canadian Chemistry Conference and Exhibition**: Solving Global Challenges with Chemistry. *Symposium: Systems Thinking in Chemistry Education*. Virtual Conference, 13-20 August 2021. Abstract. <http://www.iocd.org/WhatWeDo/publications.shtml>